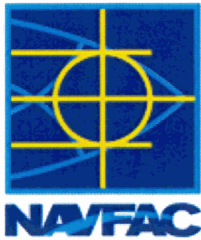


2/1/06 - 03818



# Proposed Remedial Action Plan

## Site 93, Operable Unit No. 16

**Marine Corps Base Camp Lejeune**  
**Jacksonville, North Carolina**

February 2006

### 1 Introduction

This **Proposed Remedial Action Plan (PRAP)** identifies the Preferred Alternative for addressing **groundwater** contamination at Site 93, Operable Unit (OU) 16, at Marine Corps Base (MCB) Camp Lejeune, North Carolina. MCB Camp Lejeune was placed on the **U.S. Environmental Protection Agency's (USEPA's) National Priorities List (NPL)** in November 1989. Beginning in 1995, Site 93 was included as one of several **Installation Restoration (IR)** sites addressed under the **Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA)** at MCB Camp Lejeune. OU 16 is comprised of both Site 89 and Site 93. Site 89 is currently being investigated separately under CERCLA, so this proposed remedial action will serve as a Final action for Site 93 and an Interim action for OU 16. This Plan proposes groundwater treatment through in situ chemical oxidation using permanganate, and long-term monitoring of the natural degradation of chlorinated volatile organic compounds (cVOCs). **Land use controls (LUCs)** will be maintained until site conditions achieve unrestricted use and unlimited exposure levels. This Plan provides the rationale for this preference, based on all the actions conducted at the site to date.

This Proposed Plan is issued jointly by the U.S. Department of the Navy (Navy), the lead agency for site activities, MCB Camp Lejeune, the USEPA Region IV, and the **North Carolina Department of Environment and Natural Resources (NCDENR)**. The Navy is issuing this Proposed Remedial Action Plan to fulfill public participation responsibilities as required under CERCLA Section 117(a) and Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.

This PRAP summarizes information that can be found in the Final Supplemental **Remedial Investigation (RI)** (June 1998), the Revised Final **Feasibility Study (FS)** (September 2005), and other documents contained in the Administrative Record file and Public Repositories for MCB Camp Lejeune (see Section 10). A glossary of key terms used in this PRAP is attached, and are identified in **bold print** the first time they appear.

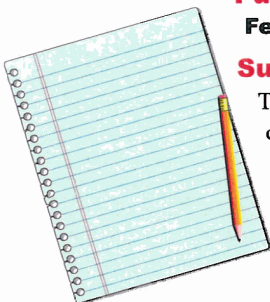
The Navy, in conjunction with MCB Camp Lejeune, NCDENR, and USEPA, will make the final decision on the remedial approach for Site 93 after reviewing and considering all information submitted during the 30-day **public comment period**. The Navy and MCB Camp

### Mark Your Calendar for the Public Comment Period

**Public Comment Period**  
**February 16 - March 16, 2006**

**Submit Written Comments**

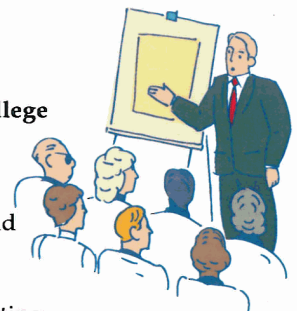
The U.S. Navy will accept written comments on the Proposed Remedial Action Plan during the public comment period.



**Attend the Public Meeting**  
**February 16, 2006**

Time - 6:30 pm  
Place - Coastal Carolina Community College  
Room CB-121  
444 Western Boulevard  
Jacksonville, NC 28546

The Navy and MCB Camp Lejeune will hold a public meeting to explain the Proposed Remedial Action Plan. Verbal and written comments will also be accepted at this meeting.



### Location of Information Repository

For more information about Site 93, check the Administrative Record at the following location:

[http://bakerenv.com/camplejeune\\_irp/default frameset.htm](http://bakerenv.com/camplejeune_irp/default frameset.htm)

The AR can be accessed through the internet from home or at the following location where the internet is available:

Onslow County Public Library  
58 Doris Avenue East  
Jacksonville, NC, 28540  
(910) 455-7350

Lejeune, along with USEPA and NCDENR, may modify the Preferred Alternative or select another **remedial action** based on new information or public comments. Therefore, public comment on the Preferred Alternative is invited and encouraged. Information on how to participate in this decision-making process is presented in Section 10.

## 2 Site Background

### 2.1 Site Description and Background

MCB Camp Lejeune is located on 236 square miles of land in Onslow County, North Carolina, adjacent to the southern side of the City of Jacksonville. Jacksonville is the largest city near the MCB Camp Lejeune and contains approximately half of the county's total population. Since 1990, much of the MCB Camp Lejeune complex has been part of Jacksonville. The areas adjacent to the MCB are generally rural. The MCB is bisected by the New River, which flows into the Atlantic Ocean in a southeasterly direction. The MCB is bordered by the Atlantic Ocean to the east, U.S. Route 17 to the west, and State Route 24 to the north. In November 1989, MCB Camp Lejeune was

placed on USEPA's National Priorities List (NPL).

Site 93, is located within the Camp Geiger area of MCB Camp Lejeune (Figures 1 and 2), near Building TC-942 at the intersection of Ninth and "E" Streets. The buildings in this portion of Camp Geiger were constructed during the Korean War and currently function as classrooms, barracks, and supply rooms for the Marine Infantry School. The operational history of Site 93 is based on information provided in the RI completed in 1998, and the Additional Plume Characterization conducted in 2002.

Historical records indicate that a 550-gallon underground storage tank (UST) storing waste oil was previously located off the southwest corner of Building TC-942; however no documentation was available regarding the installation date of the UST. The UST was removed in 1993. Based on elevated concentrations of oil and grease at the time of the tank removal, a release was suspected to have occurred. During subsequent phases of investigation, chlorinated organic contaminants were detected in groundwater.

### 2.2 Summary of Previous Investigations

Previous investigations include a UST Investigation, Remedial Investigation including a Baseline Risk Assessment and Ecological Risk Assessment (RI/BRA/ERA), and several soil and groundwater assessments completed at Site 93 from 1995 to 2005. Further detailed information is contained in the Administrative Record for MCB Camp Lejeune. A complete list of the documents included in the Administrative Record files for MCB can be obtained from the MCB Camp Lejeune Installation Restoration web site:

<http://bakerenv.com/camplejeune/irp/default frameset.htm>

The following paragraphs briefly summarize the purpose and scope of the previous investigations completed to date at Site 93.

#### UST Investigation (1995)

After the removal of the former waste oil UST at Building TC-942, an investigation was performed to determine the extent of the petroleum-related contamination in the



Figure 1 - Base Location Map

soil and groundwater associated with the UST. The investigation included the installation of monitoring wells in the vicinity of the former UST excavation and the collection of soil and groundwater samples. Chlorinated volatile organic compounds (cVOCs) were detected in soil and groundwater samples above the **North Carolina Groundwater Quality Standards (NCGWQS)**.

#### **Remedial Investigation (1998)**

In 1996 and 1997, an RI was conducted to delineate the nature and extent of contamination. Field activities included the installation of permanent and temporary monitoring wells and the collection of soil and groundwater samples analyzed for volatile organic compounds (VOCs). Soil analytical results indicated that soil had not been significantly impacted by site-related activities. Groundwater analytical results identified cVOC contamination (primarily trichloroethene [TCE]) concentrated in the surficial aquifer (less than 15 feet below ground surface [bgs]) within the immediate area of the former UST. A groundwater plume was identified as generally extending from east of Building G-920 to "E" Street, between Ninth and Tenth streets. Groundwater analytical data also suggested contaminant discharge to Edwards Creek was occurring.

#### **Natural Attenuation Evaluation (2001)**

In 2001, a preliminary natural attenuation evaluation

(NAE) was conducted to determine whether natural site conditions would encourage the natural attenuation process of degrading TCE. The results indicated limited natural attenuation of chlorinated solvents was occurring; however, the reductive dechlorination process appeared to be stalling, indicating that the reduced state of the aquifer is not enough to encourage optimal dechlorination.

#### **Additional Plume Characterization (2002)**

Additional plume characterization/delineation activities were conducted including the installation of permanent monitoring wells and the collection of groundwater samples. The analytical results identified several "hot spot" areas. The primary plume appeared related to the former UST area, with smaller "hot spot" areas downgradient. The results indicated horizontal migration of groundwater contamination had been minimal since 1995; however, vertical migration was observed. During the RI, cVOC concentrations above NCGWQS were generally limited to a depth of 15 feet bgs; while in 2002, elevated levels of cVOCs were identified up to a depth of approximately 30 feet bgs, with impacts concentrated at 15 to 19 feet bgs.

#### **Supplemental Site Investigation (2005)**

A supplemental site investigation was performed to determine the current conditions of groundwater contamination in the surficial aquifer, and collect additional



Figure 2 - Site Location Map

data to support the selection of a remedial alternative. Groundwater samples were collected from boring locations at three depths, and analyzed for VOCs, iron and manganese, chloride, nitrate, nitrite, sulfate, methane, ethane, ethene, sulfide, total dissolved solids, and total suspended solids. Once the groundwater screening results were analyzed, additional permanent monitoring wells were installed in order to complete the horizontal and vertical delineation of the shallow groundwater contamination. The results of this investigation formed the basis of the nature and extent of contamination discussed in Section 3.1.

### 3 Site Characteristics

MCB Camp Lejeune is bisected by the New River, which flows into the Atlantic Ocean in a southeasterly direction. The land varies in elevation from sea level to 70 feet above sea level. Approximately 14,000 out of 127,000 acres of land have been developed for administration, maintenance, logistics, and personnel support facilities.

At Site 93, the majority of the ground surface is relatively flat and covered by asphalt, gravel and grass. The eastern portion of the site is wooded and slopes gently toward Edwards Creek. Ground surface elevations are approximately 5 to 20 feet above mean sea level (msl) in

the vicinity of the site. Depth to groundwater (surficial aquifer) generally ranges from 7 to 14 feet above msl. In general, groundwater flows from west to east across Site 93 toward Edwards Creek.

#### 3.1 Nature and Extent of Contamination

The nature and extent of groundwater contamination is derived from 2005 data and is based on comparison of site chemical concentrations to NCGWQS (Table 1). Contaminants of concern at Site 93 were identified as cVOCs, namely tetrachloroethene (PCE), TCE, cis-1,2-dichloroethene (cis-1,2-DCE), 1,1,2,2-tetrachloroethane (1,1,2,2-PCA), and vinyl chloride. The analytical results from the Supplemental Site Investigation for the contaminants of concern are shown in Figure 3. Two areas of elevated VOC concentrations (i.e., one or two orders of magnitude above NCGWQS) were identified. The largest area of groundwater contamination was located southeast of Building TC-942 at a depth of 6 to 16 feet bgs, and a considerably smaller area was located west of Building TC-942 at a depth of 18 to 22 feet bgs.

The RI presents a summary of the risks determined by the screening level BRA and ERA, and the results are summarized in Section 4 of this Proposed Plan.

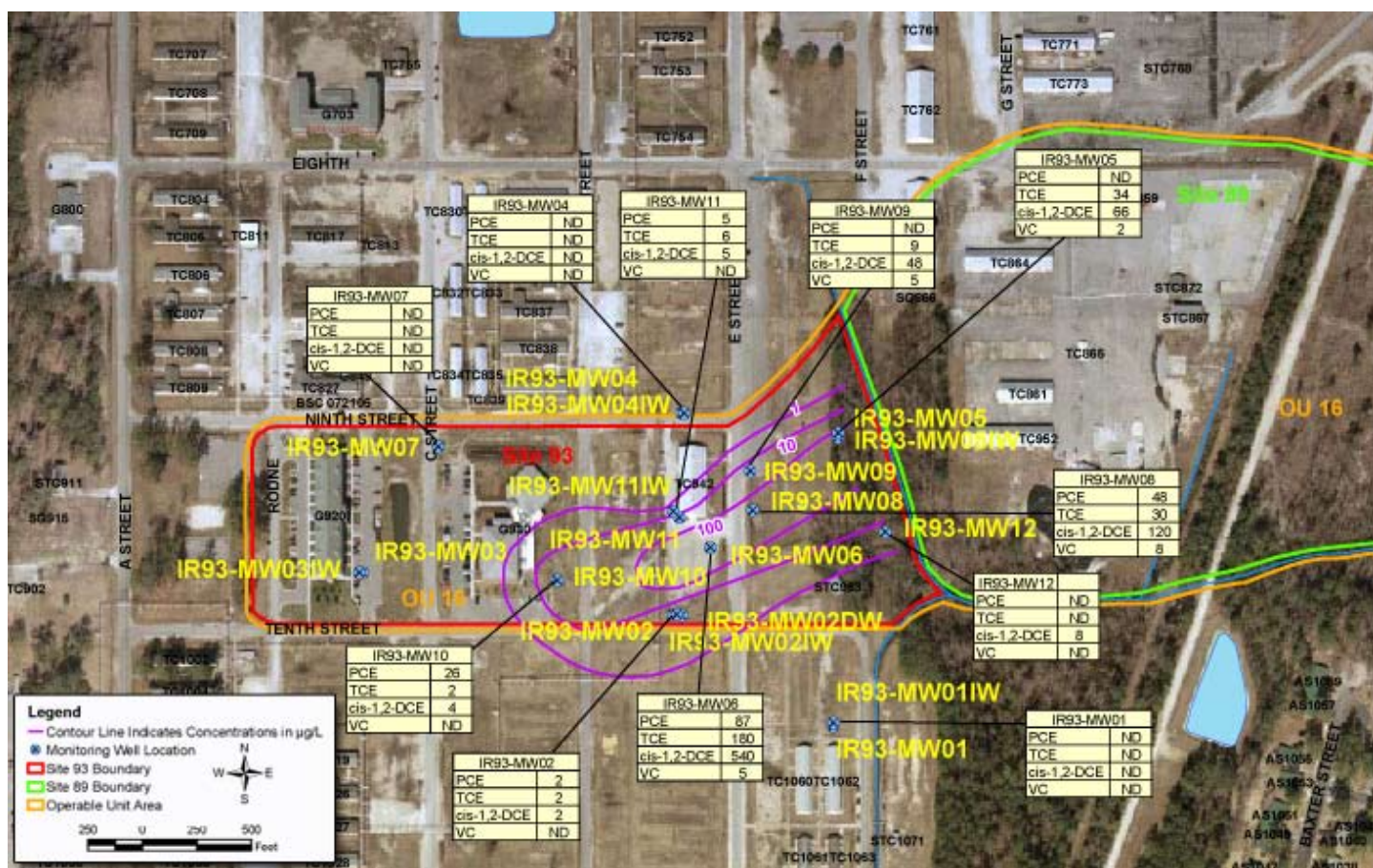


Figure 3 - Shallow Groundwater Contamination

Contaminant	NCGWQS (µg/L)	Maximum Contaminant Concentration
PCE	0.7	87
TCE	2.8	180
cis-1,2-DCE	70	540
trans-1,2-DCE	70	200
Vinyl Chloride	0.015	8

Table 1 - Contaminants of Concern at Site 93

### 3.2 Contaminant Fate and Transport

Primary fate and **contaminant migration pathways** for cVOCs at Site 93 were examined during the RI, including leaching of soil contamination to groundwater, migration of groundwater contamination, leaching of sediment contamination to surface water, and migration of contamination in surface water. The primary migration pathway for cVOCs at Site 93 was determined to be through groundwater flow in the surficial aquifer.

Analytical data collected in 2005 indicated that groundwater continues to migrate horizontally in the direction of groundwater flow, and low-level contaminant discharge may be impacting Edwards Creek. Based on available data, VOC contamination does not appear to be migrating vertically. From 2002 to 2004, VOC concentrations above NCGWQS were generally limited to a depth of 30 feet bgs.

## 4 Summary of Site Risks

A summary of the RI's BRA and ERA are included in the following subsections and in Table 2. The RI provides a more detailed analysis and evaluation of potential site risks.

### 4.1 Baseline Risk Summary

A BRA was conducted to evaluate the potential human health and/or environmental risks associated with the presence of potentially site-related constituents in subsurface soil and groundwater at Site 93. The BRA characterizes the current and potential future human health and/or environmental risks if no additional remediation is implemented. Health risks are based on a conservative estimate of the potential **carcinogenic risk** or the potential to cause other health effects not related to cancer (**noncarcinogenic risk**). A conservative estimate of risk was determined for potential exposure scenarios including future construction workers and future adult and child residents.

## What is Human Health Risk and How is it Calculated?

A screening level human health risk assessment (HHRA) estimates the risks associated with potential exposure to potentially site-related contamination. The three steps in the screening level HHRA are:

**Step 1: Identify COPCs and compare to USEPA remediation goals.**

**Step 2: Calculate corresponding risk level (CRL) for COPCs**

**Step 3: Calculate risk level using 95% upper confidence limit (UCL)**

In **Step 1**, the maximum detected constituent concentrations were compared to USEPA Region IX human-health preliminary remediation goals (PRGs) (USEPA, 2004a). In order to evaluate potential risks to the current visitor and potential future resident, surface and subsurface soil were compared to residential and industrial PRGs. Groundwater was compared to tap water PRGs.

In **Step 2**, the CRLs were calculated using maximum concentrations, acceptable risk levels, and associated PRGs. The CRLs for each constituent were added together to obtain the Cumulative Apparent Hazard Index (CAHI) and Cumulative Apparent Cancer Risk (CACR). If the CAHI by target organ (sum of the CRLs for each noncarcinogenic constituent with the same noncarcinogenic target) was greater than 0.5, or the CACR was greater than  $5 \times 10^{-5}$ , the constituents which contributed to these values were carried through to Step 3 of the screening analysis.

In **Step 3**, For constituents identified as COPCs in Step 2, a CRL was calculated as discussed above, although, the 95 percent upper confidence limit (UCL) of the mean was used in place of the maximum detected concentration to obtain a more site-specific value. The 95% UCL of the arithmetic mean of the data set was calculated, using ProUCL Version 3.0 (Singh, et al., 2004).

If the CAHI calculated by target organ was greater than 0.5, or the CACR was greater than  $5 \times 10^{-5}$ , COPCs were retained. A No Further Action is recommended when all identified COPCs could be eliminated during the three-step screening HHRA, based on potential for human health impacts.

In order to determine whether the concentrations of COPCs detected in soils at any particular site were due to site related activities or associated with background conditions, a comparison of the concentration of the COPCs detected on-site versus **background concentrations** of those contaminants on the base was performed. If the concentrations of a COPC were determined to be less than or similar to background concentrations, the contaminant was eliminated from the COPC list. Background concentrations were estimated by calculating the 95% upper tolerance limit (95% UTL) of the chemicals, using statistical analysis techniques.

Data collected during the RI revealed that no unacceptable risks or hazards associated with subsurface soil exist based on current or future site uses, as potential cancer and non-cancer risks are within USEPA acceptable risk range.

The BRA for groundwater at Site 93 indicated that the risks posed to potential future **receptors** coming in con-

tact with contaminants of potential concern (COPCs) via ingestion would most likely exceed USEPA's acceptable cancer risk range of  $10^{-6}$  to  $10^{-4}$  and non-cancer **hazard index** of 1.0. The COPCs contributing to unacceptable cancer risk are primarily PCE and arsenic. COPCs contributing to unacceptable non-cancer hazard include cis-1,2-DCE and manganese.

#### 4.2 Ecological Risk Summary

An ecological risk assessment was performed during the RI in accordance with federal, state, and Navy guidelines to identify and characterize the current and potential threats to the environment from Site 93. The ERA consisted of determining whether there are ecological receptors to protect based on the ecological setting, fate and transport of the COPCs, and any potentially complete pathways. No ecological receptors were identified as being at risk for Site 93.

Media	Baseline Risk	Ecological Risk
Subsurface Soil	Acceptable	Acceptable
Groundwater	Unacceptable	Acceptable

Table 2 - Site 93 Risk Assessment Results

#### 4.3 Current and Potential Future Site and Resource Uses

The Navy anticipates the current land use to continue indefinitely. No socio-economic and community revitalization impacts are anticipated.

## 5 Scope and Role of Response Actions

The role of the Preferred Alternative presented in this PRAP is to address all potential risks posed by Site 93 and to eliminate current exposure pathways that may pose unacceptable human health or ecological risk. It is the current judgment of the Navy and USEPA, in conjunction with NCDENR that the preferred alternative identified in this PRAP is necessary to protect public health, welfare, and the environment from actual or threatened releases of hazardous substances into the environment.

MCB Camp Lejeune was placed on EPA's NPL in November 1989. Site 93 is one of several IR sites being addressed under CERCLA at MCB Camp Lejeune. The response action for Site 93 does not include or affect any other sites at the facility.

## 6 Remedial Action Objectives

The site-specific **Remedial Action Objectives (RAOs)** are as follows:

- Reduce contaminant of concern (COC) concentrations in the highest concentration areas.
- Prevent human ingestion of water containing COCs (PCE, TCE, cis-1,2-DCE, trans-1,2-DCE, and vinyl chloride) at concentrations above NCGWQS standards or MCLs, whichever is more conservative.

## 7 Summary of Remedial Alternatives Evaluated

Remedial alternatives to address cVOCs in groundwater at Site 93 were developed and are detailed in the FS. With the exception of the no action alternative, all alternatives comply with **Applicable Relevant, and Appropriate Requirements (ARARs)**, have the same RAOs, expected outcomes, and anticipated future land uses. The no action alternative does not protect human health and the environment, but is presented as a baseline for comparison purposes. A summary of remedial alternatives is presented in Table 3.

## 8 Evaluation of Alternatives

The NCP outlines the approach for comparing remedial alternatives using the **nine evaluation criteria** listed below (see glossary for a detailed description of each). Each remedial alternative for Site 93 was evaluated against the nine criteria listed below. Alternative 1 (no action) does not achieve RAOs and is not considered further.

### 8.1 Threshold Criteria

#### Protection of human health and the environment

The LUC component of the alternatives provides protection of human health and the environment until such time as treatment reduces cVOCs to acceptable risk levels. The balance of trade-offs is the degree of treatment verses containment and the duration that LUCs must be maintained to ensure protection. The greatest protection occurs with Alternatives 3, 4, and 5 where treatment is the principal component and requires the shortest timeframe for achieving RAOs within the treatment area. Alternative 2 relies on the natural movement of groundwater, so the time frame for achieving RAOs within the treatment area is expected to be long.

#### Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

Alternatives 2 through 5 meet ARARs. As with protec-

Alternative	Components	Details	Cost	
1 – No Action	Existing groundwater plume	Not Applicable	Capital Cost	\$0
			Annual O&M	\$0
			Present-Worth	\$0
			Time Frame >20 years	
2 – Permeable Reactive Barrier (PRB) Installation and Monitored Natural Attenuation (MNA)	<ul style="list-style-type: none"> <li>- Downgradient permeable zero valent iron (ZVI) &amp; sand reactive barrier.</li> <li>- MNA</li> <li>- LUCs</li> </ul>	<ul style="list-style-type: none"> <li>- Installation of a downgradient ZVI PRB: <ul style="list-style-type: none"> <li>- Installed using a one-pass trencher</li> <li>- Trench is 2 ft wide, 500 ft long, and 30 ft in depth.</li> <li>- Long-term operation and maintenance of PRB (&gt;20 years).</li> </ul> </li> <li>- Groundwater monitoring and reporting to assess the progress of remedy over time.</li> <li>- Statutory remedy 5-year reviews.</li> </ul>	Capital Cost	\$1,127,064
			Annual O&M	\$326,431
			Present-Worth	\$1,453,496
			Time Frame >20 years	
3 – In Situ Chemical Reduction and MNA	<ul style="list-style-type: none"> <li>- Injection of ZVI slurry into the treatment area to enhance chemical reduction.</li> <li>- MNA</li> <li>- LUCs</li> </ul>	<ul style="list-style-type: none"> <li>- Injection of ZVI slurry into the treatment area via “Ferox” (pneumatic fracturing) process or geoprobe: <ul style="list-style-type: none"> <li>- 200 ft by 100 ft treatment area</li> <li>- 15-ft injection spacing for “Ferox”, 10-ft injection spacing for geoprobe</li> <li>- 8-ft vertical injection interval (8-16 ft bgs)</li> <li>- 60,000 pounds of ZVI</li> </ul> </li> <li>- Groundwater monitoring and reporting to assess the progress of remedy in treatment area and assess natural attenuation in other areas over time</li> <li>- Statutory remedy 5-year reviews</li> </ul>	<u>ZVI Injection via “Ferox”</u>	
			Capital Cost	\$859,740
			Annual O&M	\$326,431
			Present-Worth	\$1,186,172
			Time Frame: Several months in treatment area, >20 years in other areas (due to MNA)	
			<u>ZVI Injection via “Geoprobe”</u>	
			Capital Cost	\$2,307,760
			Annual O&M	\$326,431
			Present-Worth	\$2,634,191
			Time Frame: Several months in treatment area, >20 years in other areas (due to MNA)	
4 – In Situ Chemical Oxidation and MNA	<ul style="list-style-type: none"> <li>- Injection of permanganate into the treatment area to enhance chemical oxidation.</li> <li>- MNA of untreated areas downgradient</li> <li>- LUCs</li> </ul>	<ul style="list-style-type: none"> <li>- Injection of permanganate into the treatment area: <ul style="list-style-type: none"> <li>- 200 ft by 100 ft treatment area.</li> <li>- 10-ft injection spacing, 8-ft vertical injection interval (8-16 ft bgs).</li> <li>- 92,000 pounds of potassium permanganate.</li> </ul> </li> <li>- Groundwater monitoring and reporting to assess the progress of remedy in treatment area and assess natural attenuation in other areas over time.</li> <li>- Statutory remedy 5-year reviews.</li> </ul>	Capital Cost	\$770,622
			Annual O&M	\$326,431
			Present-Worth	\$1,097,054
			Time Frame: Several months in treatment area, >20 years in other areas (due to MNA)	
5 – Air Sparging and MNA	<ul style="list-style-type: none"> <li>- Continuous air sparging in the treatment area.</li> <li>- MNA of untreated areas downgradient</li> <li>- LUCs</li> </ul>	<ul style="list-style-type: none"> <li>- Continuous air sparging into the treatment area: <ul style="list-style-type: none"> <li>- 200 ft by 100 ft treatment area.</li> <li>- 20-ft spacing between sparge wells.</li> <li>- 50 1-inch diameter sparge wells installed to a depth of 30 feet bgs.</li> <li>- Long-term operation and maintenance of air sparge system (2 years).</li> </ul> </li> <li>- Groundwater monitoring and reporting to assess the progress of remedy in treatment area and assess natural attenuation in other areas over time.</li> <li>- Statutory remedy 5-year reviews.</li> </ul>	Capital Cost	\$594,529
			Annual O&M	\$566,933
			Present-Worth	\$1,161,462
			Time Frame: Several years in treatment area, >20 years in other areas (due to MNA)	

**Table 3 - Description of Alternatives for Site 93**

tion of human health and the environment, the balance of trade-offs is the preference for treatment over containment when considered against the timeframe estimated to achieve RAOs. Consequently, Alternatives 3, 4, and 5 are ranked higher for compliance with ARARs as they are expected to achieve RAOs within the treatment area in the shortest timeframe.

## 8.2 Primary Balancing Criteria

### Long-term effectiveness and permanence

Alternatives with active treatment components designed to permanently reduce cVOCs to acceptable risk levels have the greatest impact on long-term effectiveness and

permanence. Because treatment under Alternatives 3, 4, and 5 are expected to permanently achieve RAOs within the treatment area in the shortest timeframes, these alternatives are valued over the other alternatives for this criterion. However, “rebound” is a potential issue with any injection scenario (Alternatives 3 or 4) or even air sparging (Alternative 5).

### Reduction in toxicity, mobility, or volume

Alternatives with active treatment components designed to reduce cVOCs to acceptable risk levels have the greatest impact on reducing toxicity or volume. Containment components (alternatives) such as reactive barriers have the greatest impact on mobility when placed adjacent to

or within the higher concentration plume. Alternatives 3, 4 and 5 are expected to reduce cVOC levels within the treatment area very quickly thus reducing toxicity and volume; whereas under Alternative 2, toxicity, mobility, and volume are expected to be largely unaffected until the groundwater plume reaches the PRB.

#### Short-term effectiveness

Short-term effectiveness was evaluated with respect to the adverse effects the remedy may pose to the community, workers, and the environment during implementation as well as with respect to the time required to achieve RAOs. Alternatives 2 and 3 have negligible short-term risks, while short-term risks are minimized for Alternatives 4 and 5 through the use of appropriate personal protective equipment and air monitoring. Short-term effectiveness in terms of the time required to achieve RAOs will favor source area treatments (Alternatives 3, 4, and 5); while Alternative 2 is expected to require 20 years or more to achieve RAOs.

#### Implementability

This criterion was evaluated with respect to ease of implementing the remedy in terms of construction and operation, and the availability of services and materials required to implement the alternative. With respect to construction, Alternative 2 is considered to be the easiest

to implement. However, long-term O&M components (i.e., Alternatives 2 and 5) increase the difficulty of implementation as these components must be inspected, monitored, and repaired over the years the remedy is in place before achieving RAOs. In-situ chemical injection alternatives (Alternatives 3 and 4) are moderately difficult to implement in the short-term, because they rely heavily on the ability to distribute reagents in the sub-surface. Similarly, air sparging (Alternative 5) relies upon uniform distribution of air, which is uncertain at Site 93.

#### Cost

The greatest factor affecting the total implementation cost is the projected capital cost. The highest capital cost is for in situ chemical reduction via ZVI injection using a Geoprobe®, followed by the capital cost for construction of a PRB. The cost of materials is largely responsible for the increased capital cost of ZVI injection using a Geoprobe® over ZVI injection via the “Ferox” process, due to the larger number of injection points (200 versus 90). O&M costs for Alternatives 2, 3, and 4 are similar due to long-term monitoring costs required for 20 years or more. O&M costs for Alternative 5 are higher because, unlike other source zone treatments, the air sparge system is expected to operate continuously for two years, thus incurring weekly maintenance costs. Alternative 4 is the most cost-effective alternative.

CERCLA Criteria	No Action (1)	Permeable Reactive Barrier (2)	In Situ Chemical Reduction (ZVI) via “Ferox” (3a)	In Situ Chemical Reduction (ZVI) via Geoprobe® (3b)	In Situ Chemical Oxidation (Permanganate) (4)	Air Sparging (5)
<b>Threshold Criteria</b>						
Protection of Human Health and the Environment	○	●	●	●	●	●
Compliance with ARARs	○	●	●	●	●	●
<b>Primary Balancing Criteria</b>						
Long-term Effectiveness and Permanence	○	○	●	●	●	●
Reduction in Toxicity, Mobility, or Volume	○	○	●	●	●	●
Short-Term Effectiveness	○	●	●	●	○	○
Present-Worth Cost	●	●	○	○	○	○
Total Implementation Cost	●	○	○	○	○	○

Ranking: ● High ● Moderate ○ Low

Rankings are provided as qualitative descriptions of the relative compliance of each alternative with the criteria

*Table 4 - Relative Ranking of Alternatives*

## 8.3 Modifying Criteria

### State Acceptance

State involvement has been solicited throughout the CERCLA process and proposed remedy selection. The State supports the Preferred Alternative and their final concurrence will be solicited following the review of all comments received during the public comment period.

### Community Acceptance

Community acceptance will be evaluated after the public comment period for the PRAP and will be fully evaluated in the **Record of Decision (ROD)**.

A comparison of the alternatives is presented in Table 4. The Site 93 FS provides a more detailed comparative analysis of alternatives.

## 9 Preferred Alternative

The Navy and MCB Camp Lejeune, in conjunction with the USEPA and NCDENR, agree that the Preferred Alternative for Site 93 is Alternative 4, in situ chemical oxidation via permanganate injection with MNA and LUCs. Alternative 4 is expected to achieve substantial risk reduction within several months and has been successfully implemented at another site on the Base. Alternative 4 has the lowest total implementation cost.

The Preferred Alternative involves injection of permanganate in a 200 foot by 100 foot target area to promote chemical oxidation; other areas would be addressed via long-term MNA. Throughout implementation of the remedy, the Navy will restrict access as necessary to prevent unacceptable risks to human receptors from exposure to contaminants in groundwater.

LUCs for Site 93 will be implemented to prohibit the withdrawal and/or future use of water, except for monitoring from the aquifers (surficial and Castle Hayne) within 1,000 feet of the identified groundwater plume. The LUCs will also prohibit intrusive activities within the extent of current groundwater contamination unless specifically approved by both NCDENR and USEPA. The LUCs will require filing a Notification of Inactive Hazardous or Waste Disposal per North Carolina General Statute (NCGS) 130A-310.8.

Based on information currently available, the Navy, MCB Camp Lejeune, and EPA, in conjunction with NCDENR, believe the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The Navy expects the Preferred Alternative to satisfy the following requirements of CERCLA: 1) protective of human health and the environment, 2) comply with ARARs, 3) cost-effective,

4) utilize permanent solutions and alternative treatment technologies to the maximum extent practicable, and 5) satisfy the preference for treatment as a principal element. The Preferred Alternative will be re-evaluated as appropriate in response to public comment or new information.

Although the effectiveness of treatment of cVOCs in groundwater will be measured by comparison to NCG-WQS, the remedial technologies are not guaranteed to achieve cVOC concentrations at or below the standards across the site. As required by CERCLA, five-year reviews will be conducted to monitor the effectiveness of the remedy. The remedy will be considered effective and complete based on the achievement of RAOs. The need for LUCs to prevent exposure and ensure protection will be periodically reassessed as cVOC concentrations are reduced over time.

## 10 Community Participation

A community relations program is being conducted through the IR process. Public input is a key element in the decision making process. Nearby residents and other interested parties are strongly encouraged to use the comment period to relay any questions and concerns about Site 93 and the Preferred Alternative. The Navy will summarize and respond to comments in a responsiveness summary, which will become part of the official ROD.

This PRAP fulfills the public participation requirements of CERCLA Section 117(a), which specifies that the lead agency (i.e., the Navy) must publish a plan outlining any remedial alternatives evaluated for the site and identifying the Preferred Alternative. All documents referenced in this PRAP are available for public review at the information repositories (see Section 10.3 below).

A restoration advisory board (RAB) was formed in 1995. Meetings continue to be held to provide an information exchange among community members, the USEPA, NCDENR, MCB Camp Lejeune, and the Navy. These meetings are open to the public and are held quarterly.

### 10.1 Public Comment Period

The public comment period for the PRAP provides an opportunity for the community to provide input regarding the Preferred Alternative for Site 93. The public comment period will be from February 16 to March 16, 2006, and a public meeting will be held February 16, 2006 at the Carolina Coastal Community College. All interested parties are encouraged to participate in the Navy's CERCLA activities at MCB Camp Lejeune.

Comments must be postmarked no later than March 16, 2006. The loose page in the center of this PRAP may be used to provide comments to the Navy. Please fold the page, and add postage where indicated. Use of this form is not required.

## 10.2 Record of Decision

After the public comment period, the Navy and MCB Camp Lejeune, in conjunction with the USEPA and NCDENR, will determine whether the PRAP should be modified on the basis of comments received. Any required modifications will be made by the Navy, MCB Camp Lejeune, the USEPA, and the NCDENR. If the modifications substantially change the proposed remedy, additional public comment may be solicited. If not, then the Navy, MCB Camp Lejeune, USEPA, and NCDENR will prepare and sign the ROD. The ROD will detail the remedial actions chosen for the site and will include the Navy's responses to comments received during the public period.

**During the comment period, interested parties may submit written comments to the following addresses:**

**Mr. Daniel Hood**

Attn: Matt Louth  
5700 Cleveland Street, Suite 101  
Virginia Beach, VA 23462  
Phone (757) 322-4630  
Fax (757) 322-4805  
daniel.r.hood@navy.mil

**Mr. Robert Lowder**

Commanding General  
EMD/EQB  
Marine Corps Base  
PSC Box 20004  
Camp Lejeune, NC 28542-0004  
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Fax (910) 451-5997  
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**Ms. Gena Townsend**

Remedial Project Manager  
USEPA Region IV  
Sam Nunn Atlanta Federal Center  
61 Forsyth Street SW  
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Phone (404) 562-8538  
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Townsend.Gena@epa.gov

**Mr. Randy McElveen**

NC Dept. of Environment and Natural Resources  
Remedial Project Manager  
401 Oberlin Road, Suite 150  
1646 Mail Service Center  
Raleigh, NC 27699-1646  
Phone (919) 508-8467  
Fax (919) 733-2801  
Randy.McElveen@ncmail.net

## 10.3 Available Information

The Administrative Record, Community Relations Plan, Installation Restoration Program fact sheets, and final technical reports concerning Site 93 can be accessed by the public at home through the internet at [http://bak-erenv.com/camplejeune\\_irp/default\\_frameset.htm](http://bak-erenv.com/camplejeune_irp/default_frameset.htm) or at the following location where the internet is available:

Onslow County Public Library

58 Doris Avenue East

Jacksonville, North Carolina 28540

(910) 455-7350

If individuals have any questions about MCB Camp Lejeune Site 93, they may call or write to one of the contacts listed in the table on this page.

## 11

## Glossary

**Applicable or Relevant and Appropriate Requirements (ARARs):** These are Federal or State environmental rules and regulations.

**Background Concentration:** Concentrations of naturally occurring and manmade constituents, such as metals, found in groundwater, soil, sediment, and surface water in areas not impacted by spills, releases, or other site-specific activities. Background concentrations of some metals and other constituents are often at levels that may pose a risk to human health or the environment. These background-related risks should be considered (i.e.: subtracted) when calculating the risk posed by site conditions.

**Baseline Risk Assessment (BRA):** An evaluation of the risk posed to human health should remedial activities not be implemented.

**Carcinogenic Risk:** Cancer risks are expressed as a number reflecting the increased chance that a person will develop cancer if exposed to chemicals or substances. For example, USEPA's acceptable risk range for Superfund sites is  $1 \times 10^{-4}$  to  $1 \times 10^{-6}$ , meaning there is 1 additional chance in 10,000 ( $1 \times 10^{-4}$ ) to 1 additional chance in 1 million ( $1 \times 10^{-6}$ ) that a person will develop cancer if exposed to a site that is not remediated.

**Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA):** A Federal law, commonly referred to as the "Superfund" Program, passed in 1980 that provides for cleanup and emergency response in connection with numerous existing inactive hazardous waste disposal sites that endanger public health and safety or the environment.

**Contaminant Migration Pathway:** The routes that site contaminants may take to get from the source of contamination to a human being, animal, or plant.

**Ecological Risk Assessment (ERA):** An evaluation of the

risk posed to the environment if remedial activities are not performed at the site.

**Feasibility Study:** A comparative analysis of remedial alternatives developed based on the results of the RI and designed to support the selection of a remedy.

**Groundwater:** Subsurface water that occurs in soils and geologic formations that are saturated.

**Hazard Index (HI):** A number indicative of noncarcinogenic health effects that is the ratio of the existing level of exposure to an acceptable level of exposure. A value equal to or less than one indicates that the human population is not likely to experience adverse effects.

**Information Repository:** A file containing information, technical reports, and reference documents regarding an NPL site. This file is usually maintained at a location with easy public access, such as a public library.

**Installation Restoration (IR):** The Navy, as the lead agency, acts in partnership with USEPA and NCDENR to address environmental investigations at the facility through the IR program. The current IR program is consistent with CERCLA and applicable state environmental laws.

**Maximum Contaminant Level (MCL):** Enforceable standards that apply to public water systems, developed by USEPA. The highest level of a contaminant that is allowed in drinking water.

**National Oil and Hazardous Substances Contingency Plan (NCP):** Provides the organizational structure and procedures for preparing for and responding to discharges of oil and releases of hazardous substances, pollutants, and contaminants.

**National Priorities List (NPL):** A list developed by USEPA, of uncontrolled hazardous substances release sites in the United States that are considered priorities for long-term remedial evaluation and response.

#### **Nine Evaluation Criteria:**

- **Overall Protection of Human Health and Environment** – Addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
- **Compliance with ARARs** – Addresses whether a remedy will meet all of the ARARs of Federal and State environmental laws and/or justifies a waiver of the requirements.
- **Long-Term Effectiveness and Permanence** – Addresses the expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up goals have been met.

- **Reduction of Toxicity, Mobility, and Volume Through Treatment** – Discusses the anticipated performance of the treatment technologies a remedy may employ.
- **Short-Term Effectiveness** – Considers the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until clean-up goals are achieved.
- **Implementability**–Evaluates the technical and administrative feasibility of a remedy, the availability of materials and services needed to implement an option.
- **Cost** – Compares the estimated capital, operations and maintenance, and present worth costs.
- **State Acceptance** – Considers the State support agency comments on the Proposed Remedial Action Plan.
- **Community Acceptance** – Provides the public's general response to the alternatives described in the Proposed Remedial Action Plan, RI, and FS reports. The specific responses to the public comments are addressed in the Responsiveness Summary section of the ROD.

**Noncarcinogenic Risk:** Noncancer Hazards (or risk) are expressed as a quotient that there is a level of exposure (the reference dose) below which it is unlikely for even a sensitive population to experience adverse health effects. For example, USEPA's threshold level for Superfund sites is 1, meaning that if the exposure exceeds the threshold, there may be a concern for potential noncancer effects.

**North Carolina Department of Environment and Natural Resources (NCDENR):** The state agency responsible for administration and enforcement of state environmental regulations.

**North Carolina Groundwater Quality Standards (NCGWQS):** Enforceable standards developed by NCDENR. They are the maximum allowable concentrations resulting from any discharge of contaminants to the land or waters of the state, which may be tolerated without creating a threat to human health or which would otherwise render the groundwater unsuitable for its intended best usage.

**Proposed Remedial Action Plan (PRAP):** A document that presents and requests public input regarding the proposed cleanup alternative.

**Public Comment Period:** The time allowed for the members of an affected community to express views and concerns regarding an action proposed to be taken by USEPA, such as a rulemaking, permit, or Superfund-remedy selection.

**Receptors:** Humans, animals, or plants that may be exposed to risks from contaminants related to a given site.

**Remedial Action:** A cleanup method proposed or selected to address contaminants at a site.

**Remedial Action Alternatives (RAOs):** Objectives

of remedial actions that are developed based on contaminated media, contaminants of concern, potential receptors and exposure scenarios, human health and ecological risk assessment, and attainment of regulatory cleanup levels, if any exist.

**Remedial Investigation (RI):** A study of a facility that supports the selection of a remedy where hazardous substances have been disposed or released. The RI identifies the nature and extent of contamination at the facility.

**Record of Decision (ROD):** A legal document that describes the cleanup action or remedy selected for a site, the basis for choosing that remedy, and public comment on alternative remedies.

**USEPA:** United States Environmental Protection Agency. The Federal agency responsible for administration and enforcement of CERCLA (and other environmental regulations), and with final approval authority for the selected ROD.

Please print or type your comments for Site 93 below.

— FOLD HERE —

Place  
stamp  
here

Mr. Daniel Hood  
Attn: Matt Louth  
5700 Cleveland Street, Suite 101  
Virginia Beach, VA 23462